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IRW before measure
Deg rate

31 December 1996

Captain Ed Marchand
AFCEE/ERT
3207 North Road, Building 532
Brooks AFB, TX 78235-5363

Subject: Operations and Maintenance Manual, Record Drawings, and Summary of Initial Results for Expanded Bioventing System at Installation Restoration Program (IRP) Site 11, Beale Air Force Base, California
(Contract No. F41624-92-8036, Order 17)

Dear Captain Marchand:

This letter transmits three copies of the Operations and Maintenance (O&M) Manual prepared for the expanded bioventing system installed at IRP Site 11, Beale Air Force Base (AFB), California. We are also including one set of record drawings for the installed system. This letter provides a summary of the work performed by Parsons Engineering Science, Inc. (Parsons ES) at IRP Site 11 between May and August 1996, and presents initial system operating parameters and sampling results. Copies of this letter, two sets of record drawings, and three copies of the O&M Manual also have been sent to Ms. Carol Gaudette at Beale AFB.

Summary of Field Activities

The previously installed pilot-scale bioventing system at the site, consisting of one air injection vent well (VW) and three soil vapor monitoring points (VMPs), was expanded by installing two additional air injection VWs; two additional VMPs; an upgraded blower system; and associated piping, controls, and electrical service. The system was installed south of Building 1225, the Aircraft Ground Equipment (AGE) Maintenance facility. Figure 1 (attached), taken from the record drawings, shows the site layout with the locations of the bioventing system components. Complete record drawings showing the final design details of the system components are provided in the attached O&M Manual.

System installation was performed by Parsons ES and subcontractors under the supervision of Parsons ES between May 28 and July 8, 1996. System startup and monitoring was performed by Parsons ES personnel between July 9 and August 6, 1996. The system was installed and monitored as described in the *Work Plan for Expanded Bioventing System, Aircraft Ground Equipment (AGE) Maintenance Area, IRP Site 11, Beale Air Force Base, California* (Parsons ES, 1995). There were no significant deviations from the work plan.

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Summary of Initial Sampling Results

Five soil and seven soil vapor samples were collected by Parsons ES for laboratory analysis prior to system startup to establish baseline conditions. The soil samples were analyzed by Curtis and Tompkins. Ltd. of Berkeley, California for benzene, toluene, ethylbenzene, and xylenes (BTEX), total petroleum hydrocarbons (TPH), and halogenated volatile organic compounds (HVOCs). Soil samples with detectable concentrations of total TPH or BTEX were also analyzed for soluble concentrations of TPH and BTEX. One soil sample from an uncontaminated interval was analyzed for total organic carbon (TOC).

The soil vapor samples were analyzed by Air Toxics, Ltd. of Folsom, California for volatile organic compounds (VOCs), including HVOCs, BTEX, and TPH. In addition, soil vapor samples were analyzed in the field using direct-reading instruments for oxygen, carbon dioxide, total volatile hydrocarbons (TVH), and ionizable compounds. Soil and soil vapor results are summarized in Tables 1, 2, and 3, and sampling locations are shown on Figure 1.

The results from this investigation generally agreed with results from prior investigations (Law, 1995). Based on the soil and soil vapor sample results collected during this investigation and prior investigations, the horizontal and vertical extent of contamination has been well characterized. Hydrocarbon contamination at the site is concentrated in the soil zone extending from a depth of approximately 5 feet below ground surface (bgs) to 30 bgs, based on soil headspace screening during drilling operations, the analytical results for soil and soil vapor, and the field results for soil vapor. The contamination is primarily located in vadose zone soils around and beneath the former underground storage tanks (USTs) and immediately north of the paved area near the fuel pump island and drainage channel, where spills from refueling operations have occurred. The previously installed pilot-scale system was designed to remediate vadose zone soils associated with the former USTs and the expanded system was designed to additionally remediate vadose zone soils north of the paved area.

For soil samples collected during this investigation, the maximum concentrations of TPH (2,500 milligrams per kilogram [mg/kg]) and BTEX (310.8 mg/kg) were detected in the sample collected from 10 feet bgs at VW-2. Contaminated soil in this area was found to have the highest soil vapor concentrations during a previous soil vapor survey conducted throughout the site (Law, 1995), but was beyond the radius of influence of the pilot-scale bioventing system installed by Parsons ES in 1993 (ES, 1993). At the remaining soil sample locations, total TPH concentrations did not exceed 300 mg/kg and soluble TPH and BTEX were not detected. HVOCs were not detected in any of the soil samples collected at the site during this or prior investigations.

For soil vapor samples collected during this investigation, the maximum concentrations of TPH (4,200 parts per million by volume [ppmv]) and BTEX (150 ppmv) were detected in the sample collected from 24 feet bgs at VMP-3 (VMP3-24). VMP-3 is located outside the

former UST excavation, but near the surface water drainage channel where surface spills from refueling operations probably have collected. VMP-3 was located within the expected radius of influence of the pilot test bioventing system; however, the soil vapor analytical and field results indicate that some residual soil contamination probably still exists in the near surface soils near VMP-3. It is worth noting that although soil vapor concentrations were highest at VMP3-24, the TPH and BTEX concentrations measured during this investigation are lower than those measured at this same location in 1994 after one year of pilot test operations (4,900 ppmv TPH and 430.7 ppmv BTEX). HVOCs were detected at relatively low concentrations (less than 3 ppmv) during this investigation, consistent with the results from prior investigations. Based on these soil vapor concentrations and the lack of detectable HVOCs in soil, there does not appear to be a significant source of HVOCs within the area of the expanded bioventing system.

Based on equilibrium soil vapor concentrations measured during this investigation and those measured initially at the site in May 1993 (Parsons ES, 1995; ES, 1993), bioventing has been successful in reducing TPH and BTEX concentrations and oxygen demand of vadose zone soils at the former UST location. However, there still appears to be some oxygen demand in the shallower soils based on lower oxygen concentrations measured at VMP1-24, VMP2-24, VMP3-24, and VMP5-10. Although depleted oxygen concentrations and relatively higher hydrocarbon concentrations in soil vapor were not measured at VW-2 (the location of the maximum soil hydrocarbon concentrations), the long screened interval necessary for the VW construction probably produced a soil vapor sample that is a composite from both contaminated and uncontaminated soil conditions. Extended air injection into VW-2 and VW-3 should result in successful oxygen delivery and remediation of contaminated soils which are within the screened depths and the treatment radius of the VWs.

Initial Operation Parameters

The expanded bioventing system was started on July 9, 1996. Air was injected only into VW-2 and VW-3 so that all 5 VMPs could be used to evaluate potential vapor migration from the areas of the site undergoing air injection for the first time. The air injection flow rate for both VW-2 and VW-3 was adjusted to approximately 10 cubic feet per minute (cfm) (a total blower flow rate of 20 cfm). This air flow rate was calculated to be sufficient to meet the oxygen demand of contaminated soils based on respiration tests conducted during the bioventing pilot test at the site (ES, 1993) and based on design methods detailed in the general engineering evaluation/cost analysis (EE/CA) document for bioventing (AFCEE, 1996). The air injection pressure was 10 inches of water. Air flow rate and pressure readings also were taken 24 hours after system startup. The air flow rate into VW-3 increased slightly to 11 cfm and was readjusted to 10 cfm. The air flow rate into VW-2 remained constant at 10 cfm. The air injection pressure remained constant at 10 inches of water.

The VMPs at the site were primarily installed to evaluate potential vapor migration; therefore, the VMPs are located near the expected radius of influence of the VWs and at approximately the same distance from the VWs. Therefore, as expected, the pressure response measured at the VMPs did not vary significantly. The pressure response after 24 hours of air injection was measured between 0.80 and 1.0 inches of water in all VMP intervals except VMP-5 at 40 feet bgs, where it was measured slightly higher at 1.4 inches of water. Based on pressure response and soil air permeability measured during the pilot test, the pressure responses after 24 hours were probably not indicative of steady-state conditions and were expected to decrease with extended air injection.

Evaluation of Potential Vapor Migration

At the request of the California Regional Water Quality Control Board (RWQCB), Central Valley Region, and California Department of Toxic Substances Control (DTSC), potential vapor migration was evaluated by performing an additional soil vapor monitoring event on August 6, 1996, approximately 4 weeks after system startup. All VMP intervals were sampled and analyzed in the field using direct-reading instruments for oxygen, carbon dioxide, TVH, and ionizable compounds. In addition, all VMPs that were initially sampled for analytical laboratory analysis were resampled for analytical laboratory analysis at the 4-week monitoring event using the same methods. The analytical sampling results are shown in Table 2 and the field sampling results are shown in Table 3. A comparison of field sampling results for the initial and 4-week monitoring events is shown on Figure 2.

With the exception of the sample taken at VMP-4 at 10 feet bgs (VMP4-10), no significant increases in soil vapor concentrations were measured. Most concentrations either remained at approximately the same level or decreased. For those locations where concentrations increased (including VMP4-10), the field screening and analytical laboratory results indicate that the increases were primarily due to movement of petroleum hydrocarbon vapors and not due to movement of HVOCs. These hydrocarbon vapors are expected to biodegrade as they move horizontally through the soil. The lack of significant increases in HVOC concentrations in soil vapor are consistent with the results from analytical soil samples, in which no detectable concentration of HVOCs were found.

Ambient air monitoring was also conducted during system startup operations as required in the work plan; no detectable concentrations (> 1 ppmv) of TVH or ionizable compounds were measured. The lack of detectable concentrations measured in ambient air during operation of the expanded bioventing system using field instruments is consistent with more detailed ambient air monitoring conducted at the site during pilot test operations using an emission isolation flux chamber and samples submitted for analytical laboratory analysis (ES, 1993).

Extended Operation Parameters

Oxygen and carbon dioxide concentrations were measured in soil vapor at the VMPs before system startup and at the 4-week monitoring event to determine the volume of soil being oxygenated by the expanded bioventing system. Air injection was continued at only VW-2 and VW-3. The air injection flow rates and air injection pressure remained constant between the initial startup and the 4-week monitoring event. Based on increases in oxygen concentration at most depths at VMP-3, VMP-4, and VMP-5 and smaller changes or decreases in oxygen concentrations at VMP-1, VMP-2, and VW-1, the estimated radius of oxygen influence is between 70 and 80 feet, consistent with the results from the pilot test operations.

As expected, pressure response measured in the VMPs decreased between initial startup and extended operations. The steady-state pressure response after extended operations was measured between 0.15 and 0.39 inches of water in all VMP intervals except VMP-4 at 10 feet bgs, where it was measured at 0.02 inches of water. The pressure responses were consistent with the results from oxygen monitoring and indicate that the VMPs are near or slightly beyond the effective treatment radius established with air injection at VW-2 and VW-3.

Recommendations

Since vapor migration of HVOCs does not appear to be a concern at the site, the effective treatment radius could be improved by injecting air into VW-1 in addition to the current air injection into VW-2 and VW-3. By adding air injection at VW-1 at the same air flow rate of 10 cfm, the treatment radius could be expanded to include the soils previously being treated by the pilot test system near the former USTs, but without increasing the potential for vapor migration. The soils near the former USTs still appear to be somewhat oxygen depleted based on both initial soil vapor oxygen concentrations and those measured at the 4-week monitoring event at VMP1-24 and VMP2-24.

As recommended in the work plan, since HVOCs were not detected in soil samples collected during this investigation and are not migrating due to air injection, Parsons ES also recommends that analysis for HVOC be eliminated from future soil and soil vapor sampling at the site. Once concurrence has been received from the RWQCB and the DTSC, air injection into VW-1 will be initiated and soil and soil vapor samples collected for future laboratory analysis will only be analyzed for TPH and BTEX.

This site has also been funded for Options 1 and 2 under the AFCEE Extended Bioventing Project. Option 1 involves O&M support for 1 year and system monitoring at the end of the year. The O&M support period began following system startup and will continue until mid-July 1997. In late August 1997, Parsons ES will return to the site and perform respiration testing and soil vapor sampling. The results of these monitoring activities will be used to

develop recommendations for further action at this site. If Option 1 sampling results indicate that the site can be closed after the initial year of bioventing system operation, closure soil sampling (Option 2) may be performed.

If you have any questions or comments regarding the information contained in this letter or in the enclosed O&M Manual, please contact Marcus Pierce or myself at (510) 769-0100.

Very truly yours,

PARSONS ENGINEERING SCIENCE, INC.

Michael B. Phelps, P.E.
Site Manager
Senior Environmental Engineer

MBP/bd

Attachments: References, Figure 1-2, Tables 1-3
Enclosure: O&M Manual

cc: John Ratz (Parsons ES - Denver, Project Manager)
Marcus Pierce (Parsons ES - Alameda)
Carol Gaudette (Beale AFB)

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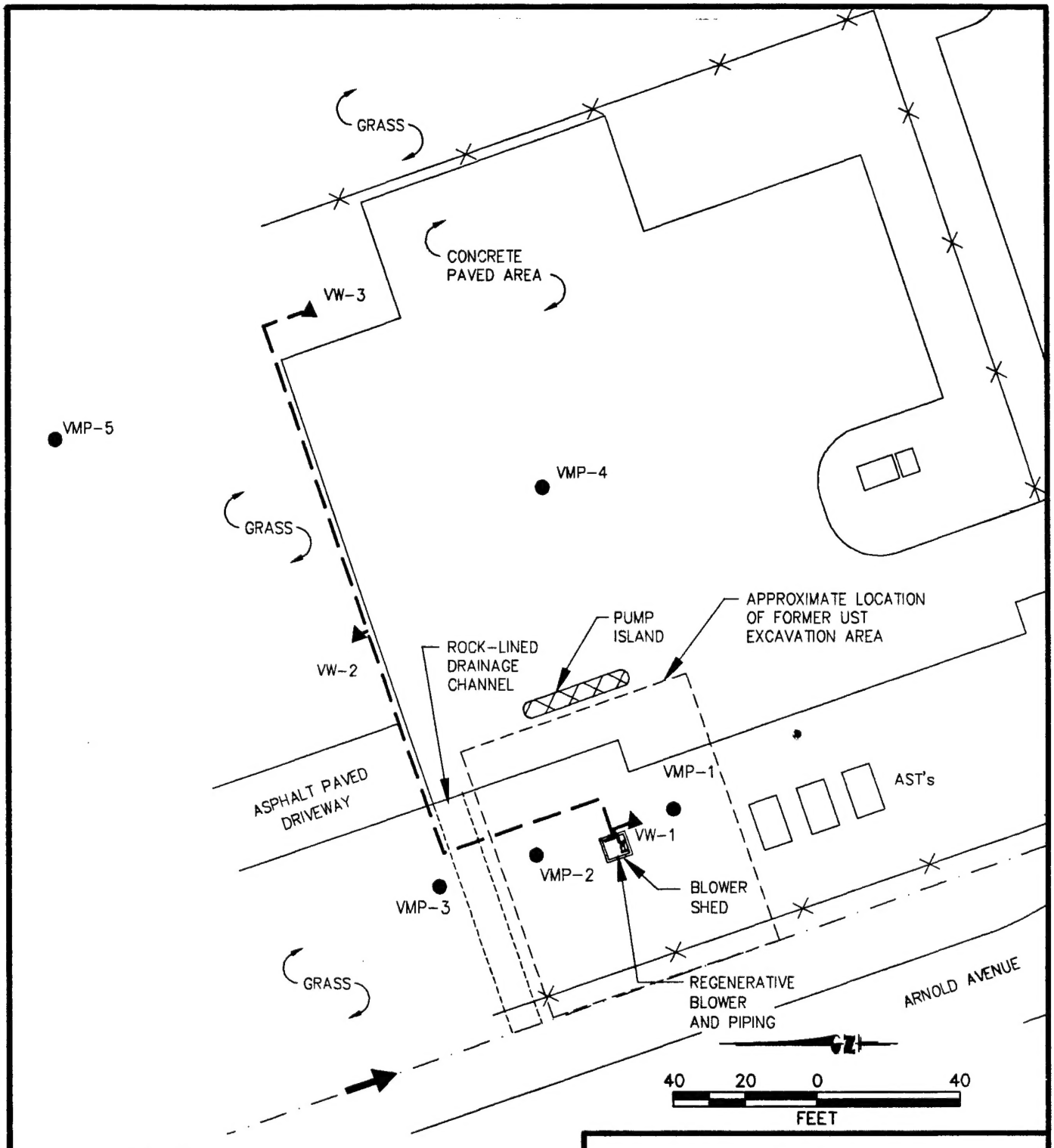
Parsons Engineering Science, Inc. (Parsons ES), 1993. *Bioventing Pilot Test Work Plan (Part I) and Draft Interim Pilot Test Results (Part II) for Aircraft Ground Equipment Maintenance Area (Site 11), Beale Air Force Base, California*. October.



LEGEND

VW-1 ▲ AIR INJECTION VENT WELL

VMP-1 ● VAPOR MONITORING POINT

SUBSURFACE AIR SUPPLY MANIFOLD

UNLINED DRAINAGE CHANNEL/ DIRECTION OF SURFACE FLOW

FENCE

FIGURE 1

SITE LAYOUT
EXPANDED BIOVENTING SYSTEM

IRP Site 11
Beale AFB, California

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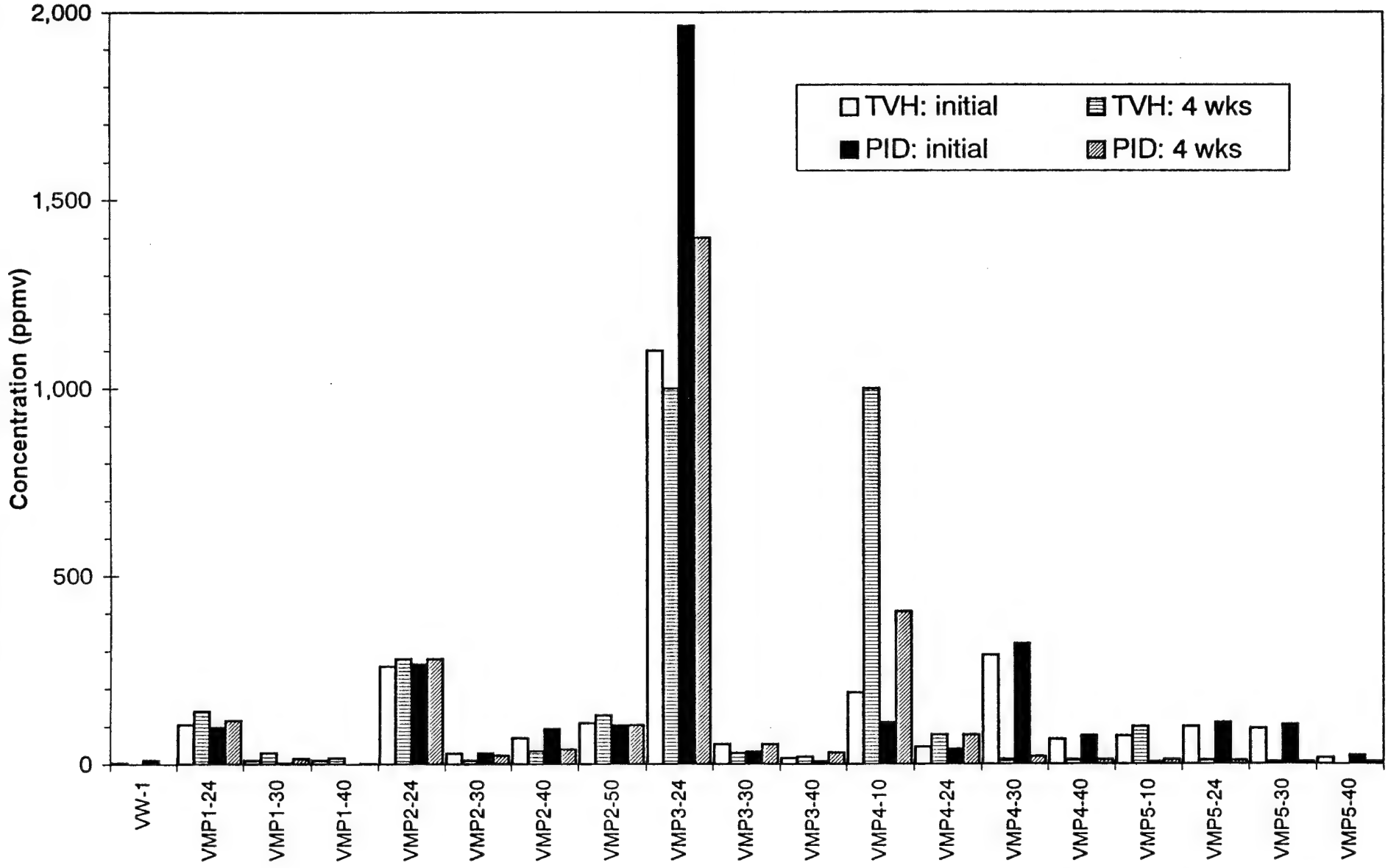


FIGURE 2

COMPARISON OF SOIL VAPOR CONCENTRATIONS BEFORE AND AFTER SYSTEM STARTUP

IRP Site 11 - Beale AFB, California

PARSONS ENGINEERING SCIENCE, INC.

\726876\20\REPORT\FIGS_L8.CDR 12/06/96

TABLE 1
SOIL ANALYTICAL SAMPLING RESULTS
EXPANDED BIOVENTING SYSTEM
IRP SITE 11 - BEALE AFB, CALIFORNIA

			Sample Location - Depth (feet below ground surface)				
Analyte	Units	Method	VW2-10	VW2-50.5	VW3-24	VMP4-13	VMP5-18.5
Total Hydrocarbons							
TPH-g	mg/kg	SW5030/SW8015m	2,500	<1.2	<1.1	3.5 Y	<1.2
TPH-JP5	mg/kg	SW3550/SW8015m	160 YL	<1.2	7 YH	<1.2	90 YH
TPH-d	mg/kg	SW3550/SW8015m	60 YLH	<1.2	18 YH	<1.2	300 YH
TPH-mo	mg/kg	SW3550/SW8015m	9.1 YL	<5.8	60 YH	<6	290 YL
Benzene	mg/kg	SW5030/SW8020	6.8	<0.0058	<0.0057	<0.006	<0.0062
Toluene	mg/kg	SW5030/SW8020	94	<0.0058	<0.0057	<0.006	<0.0062
Ethylbenzene	mg/kg	SW5030/SW8020	37	<0.0058	<0.0057	<0.006	<0.0062
Total Xylenes	mg/kg	SW5030/SW8020	173	<0.0058	<0.0057	<0.006	<0.0062
Total Halogenated VOCs							
HVOCs	mg/kg	SW5030/SW8010	all ND	all ND	all ND	all ND	all ND
Soluble Hydrocarbons							
TPH-JP5	ug/L	DI-WET/SW8015m	1,900 YLZ	n.a.	<50	n.a.	<50
TPH-d	ug/L	DI-WET/SW8015m	610 YLZ	n.a.	<50	n.a.	<50
TPH-mo	ug/L	DI-WET/SW8015m	<300	n.a.	<300	n.a.	<300
Benzene	ug/L	DI-WET/SW8020	87	n.a.	n.a.	n.a.	n.a.
Toluene	ug/L	DI-WET/SW8020	950	n.a.	n.a.	n.a.	n.a.
Ethylbenzene	ug/L	DI-WET/SW8020	260	n.a.	n.a.	n.a.	n.a.
Total Xylenes	ug/L	DI-WET/SW8020	1,950	n.a.	n.a.	n.a.	n.a.
Other							
Moisture	%	ASTM D-2216	24	14	13	17	19
TOC	mg/kg	SW9060	n.a.	<50	n.a.	n.a.	n.a.

Notes:

TPH-g : Total petroleum hydrocarbons as gasoline
TPH-JP5 : Total petroleum hydrocarbons as jet fuel #5 (C10-C16)
TPH-d : Total petroleum hydrocarbons as diesel (C12-C22)
TPH-mo : Total petroleum hydrocarbons as motor oil (C22-C50)
TOC : Total Organic Carbon
DI-WET : deionized water extraction, waste extraction test

<0.50 : Not detected at indicated concentration.
H : heavier hydrocarbons than indicated in standard
L : lighter hydrocarbons than indicated in standard
Y : sample exhibits fuel pattern which does not resemble standard
Z : sample exhibits unknown single peak or peaks
n.a. : Not analyzed

TABLE 2
SOIL VAPOR ANALYTICAL SAMPLING RESULTS
EXPANDED BIOVENTING SYSTEM
IRP SITE 11 - BEALE AFB, CALIFORNIA

			Sample Location - Screen Depth (feet below ground surface)													
			VW2-(10-40)			VW3-(10-40)		VMP3-24		VMP4-10			VMP4-30		VMP5-10	
Analyte	Units	Method	9-Jul-96		6-Aug-96	9-Jul-96	6-Aug-96	9-Jul-96	6-Aug-96	9-Jul-96		6-Aug-96	9-Jul-96	6-Aug-96	9-Jul-96	6-Aug-96
Petroleum Hydrocarbons																
TPH-g	ppmv	TO-14	52	[28]	n.a.	5.3	n.a.	4,200	3,600	99	[150]	1,200	<0.360	0.66	1.8	0.072
Benzene	ppmv	TO-14	0.28	[0.069]	n.a.	0.0058	n.a.	<1.5	0.89	0.048	[0.100]	0.23	<0.036	<0.0012	0.0038	<0.00070
Toluene	ppmv	TO-14	0.26	[0.055]	n.a.	0.0021	n.a.	<1.5	<0.67	<0.021	[<0.0090]	<0.049	<0.036	<0.0012	0.0012	0.00078
Ethylbenzene	ppmv	TO-14	<0.037	[<0.036]	n.a.	<0.00073	n.a.	<1.5	<0.67	<0.021	[<0.0090]	<0.049	<0.036	<0.0012	<0.00078	<0.00070
Total Xylenes	ppmv	TO-14	0.88	[0.79]	n.a.	0.0101	n.a.	150	62	<0.021	[<0.0090]	<0.049	<0.036	<0.0012	<0.00078	<0.00070
Hexane	ppmv	TO-14	0.64	[<0.14]	n.a.	<0.0029	n.a.	<6.0	2.7	5.6	[7.0]	10	<0.14	<0.0046	<3.1	<0.0028
Heptane	ppmv	TO-14	<0.15	[<0.14]	n.a.	<0.0029	n.a.	<6.0	<2.7	<0.082	[<0.036]	3.7	<0.14	<0.0046	<3.1	<0.0028
1,2,4-TMB	ppmv	TO-14	0.17	[0.30]	n.a.	0.0032	n.a.	340	170	<0.021	[<0.0090]	0.078	<0.036	0.0048	0.0010	0.0011
1,3,5-TMB	ppmv	TO-14	0.40	[0.33]	n.a.	<0.00073	n.a.	190	99	<0.021	[<0.0090]	0.049	<0.036	0.0016	<0.00078	<0.00070
4-Ethyltoluene	ppmv	TO-14	0.32	[0.36]	n.a.	0.0047	n.a.	170	61	<0.082	[<0.036]	<0.190	<0.14	<0.0046	<3.1	<0.0028
Halogenated VOCs																
PCE	ppmv	TO-14	<0.037	[<0.036]	n.a.	<0.00073	n.a.	<1.5	<0.67	<0.021	[<0.0090]	<0.049	<0.036	<0.0012	0.0031	0.0019
TCE	ppmv	TO-14	<0.037	[<0.036]	n.a.	0.0092	n.a.	<1.5	<0.67	0.32	[0.37]	1.2	<0.036	<0.0012	0.0059	0.0037
cis-1,2-DCE	ppmv	TO-14	<0.037	[<0.036]	n.a.	0.22	n.a.	<1.5	<0.67	1.2	[1.4]	2.6	<0.036	<0.0012	<0.00078	<0.00070
trans-1,2-DCE	ppmv	TO-14	<0.15	[<0.14]	n.a.	0.033	n.a.	<6.0	<2.7	0.22	[0.30]	1.2	<0.14	<0.0046	<3.1	<0.0028
Vinyl Chloride	ppmv	TO-14	<0.037	[<0.036]	n.a.	0.00075	n.a.	<1.5	<0.67	0.078	[0.10]	<0.049	<0.036	<0.0012	<0.00078	<0.00070
1,1,1-TCA	ppmv	TO-14	0.14	[0.084]	n.a.	<0.00073	n.a.	<1.5	<0.67	<0.021	[<0.0090]	<0.049	0.037	<0.0012	<0.00078	<0.00070
1,1-DCE	ppmv	TO-14	<0.037	[<0.036]	n.a.	<0.00073	n.a.	<1.5	<0.67	<0.021	[<0.0090]	0.069	<0.036	<0.0012	<0.00078	<0.00070
1,2-DCA	ppmv	TO-14	0.19	[<0.036]	n.a.	0.012	n.a.	<1.5	<0.67	<0.021	[<0.0090]	<0.049	<0.036	<0.0012	<0.00078	<0.00070
Chloroform	ppmv	TO-14	<0.037	[<0.036]	n.a.	<0.00073	n.a.	<1.5	<0.67	<0.021	[<0.0090]	<0.049	<0.036	<0.0012	0.0021	0.0010
Methylene Chloride	ppmv	TO-14	<0.037	[0.043]	n.a.	<0.00073	n.a.	<1.5	<0.67	<0.021	[<0.0090]	<0.049	<0.036	<0.0012	<0.00078	<0.00070
Freon 12	ppmv	TO-14	<0.037	[<0.036]	n.a.	0.00090	n.a.	<1.5	<0.67	<0.021	[<0.0090]	<0.049	<0.036	<0.0012	0.00090	<0.00070
Other VOCs																
2-propanol	ppmv	TO-14	<0.15	[<0.14]	n.a.	<0.0029	n.a.	<6.0	<2.7	<0.082	[<0.036]	<0.190	<0.14	<0.0046	0.0051	<0.0028
2-hexanone	ppmv	TO-14	<0.15	[<0.14]	n.a.	<0.0029	n.a.	<6.0	<2.7	<0.082	[<0.036]	<0.190	<0.14	<0.0046	0.0032	<0.0028
Carbon Disulfide	ppmv	TO-14	<0.15	[<0.14]	n.a.	<0.0029	n.a.	<6.0	<2.7	<0.082	[<0.036]	<0.190	<0.14	<0.0046	0.021	0.013

Notes:

TPH-g : Total petroleum hydrocarbons as gasoline
TMB : Trimethylbenzene
n.a. : Not analyzed

<0.50 : Not detected at indicated concentration.
[0.50] : Field duplicate analysis result

TABLE 3
SOIL VAPOR FIELD SAMPLING RESULTS
EXPANDED BIOVENTING SYSTEM
IRP SITE 11 - BEALE AFB, CALIFORNIA

	Analyte:	Oxygen		Carbon Dioxide		TVH		PID	
	Units:	(%)		(%)		(ppmv)		(ppmv)	
Location	Depth (ft bgs)	8-Jul-96	6-Aug-96	8-Jul-96	6-Aug-96	8-Jul-96	6-Aug-96	8-Jul-96	6-Aug-96
VW-1	(10-50)	19.9	17.2	0.3	0.7	12	25	3.9	0.4
VW-2	(10-40)	20.5	20.8	0.3	0.2	200	4	223	0.0
VW-3	(10-40)	20.8	20.8	0.0	0.2	2	0	10.0	0.0
VMP-1	24	7.5	2.3	3.3	> 5.0	105	140	98.8	115
	30	20.0	20.5	0.5	0.5	10	30	1.9	15.2
	40	19.0	19.8	0.5	0.4	10	16	0.4	0.7
VMP-2	24	9.5	11.5	3.5	4.6	260	280	266	280
	30	19.0	20.8	0.3	0.1	28	10	30.0	23.0
	40	19.5	20.0	0.8	0.5	70	35	94.4	40.0
	50	17.5	16.5	2.0	2.9	110	130	104	104
VMP-3	24	12.0	17.5	3.0	2.0	1,100	1,000	1,964	1,400
	30	18.5	20.5	0.5	0.2	53	30	34.1	53.0
	40	18.5	20.5	0.3	0.1	16	20	7.6	31.5
VMP-4	10	18.0	16.5	1.9	2.8	190	1,000	112	405
	24	19.5	19.3	0.8	1.3	46	78	41.1	78.0
	30	20.8	20.6	0.0	0.3	290	14	319	21.0
	40	20.8	20.8	0.3	0.3	66	12	75.6	12.8
VMP-5	10	11.9	16.8	4.5	> 5.0	74	100	5.8	12.5
	24	20.8	20.8	0.3	0.2	100	11	111	10.5
	30	20.8	20.8	0.3	0.1	94	6	105	6.5
	40	20.8	20.8	0.3	0.2	16	0	21.9	6.1

Notes:

ppmv : parts per million by volume

TVH : Total volatile hydrocarbons (field instrument)

PID : Photoionization detector (field instrument)

> 5.0 : Concentration greater than indicated maximum detection limit

RECORD DRAWINGS FOR

EXTENDED BIOVENTING TREATABILITY TEST
IRP SITE 11
AIRCRAFT GROUND EQUIPMENT MAINTENANCE AREA
BEALE AIR FORCE BASE

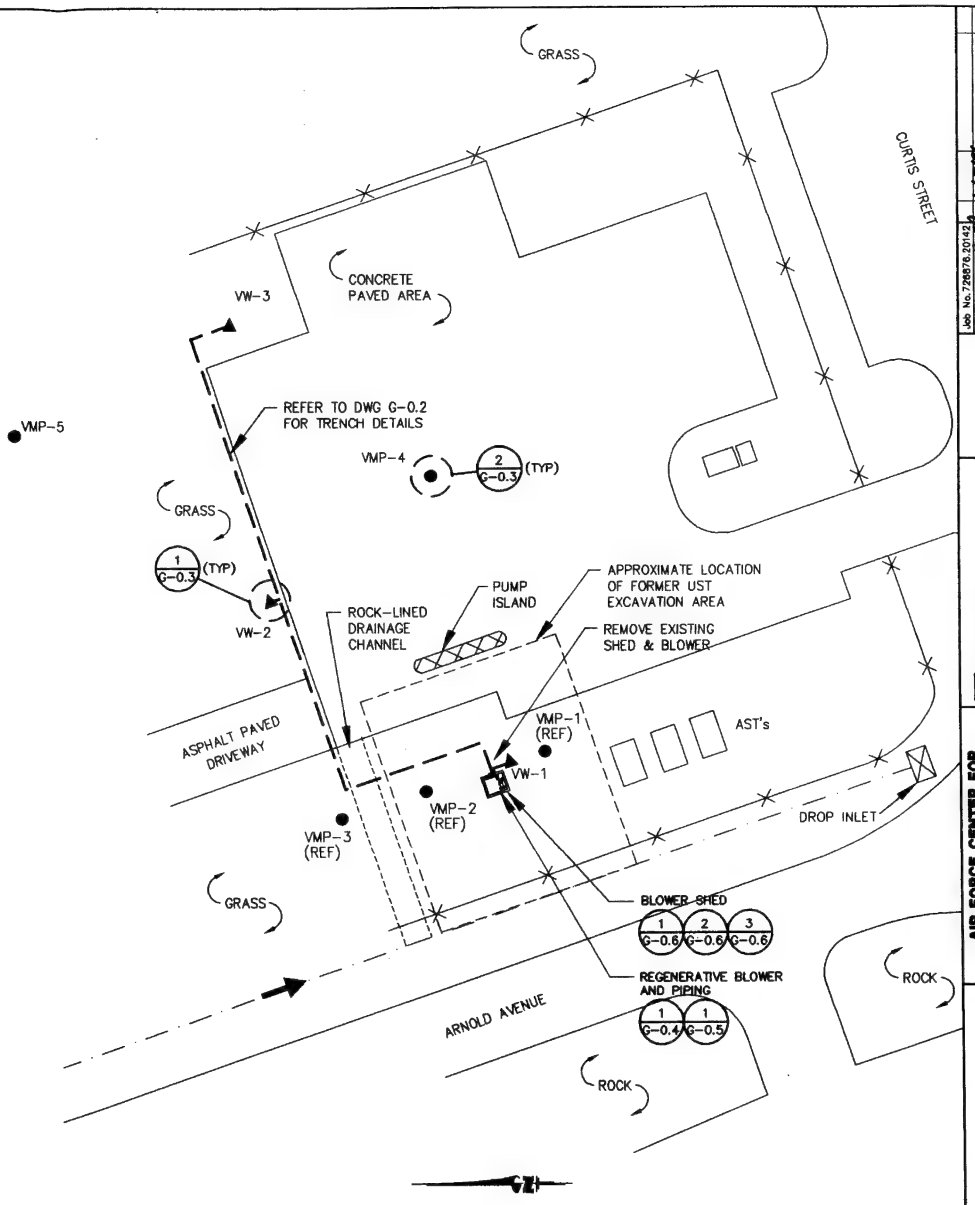
PREPARED FOR

AFCEE

NOVEMBER 1996

DRAWING INDEX

DRAWING NO	DRAWING NAME
G-0.1	TITLE SHEET AND SITE LAYOUT
G-0.2	LEGEND AND STANDARD TRENCH DETAILS
G-0.3	VENT WELL AND MONITORING POINT STANDARD DETAILS
G-0.4	BLOWER P & ID
G-0.5	BLOWER PIPING LAYOUT DETAIL
G-0.6	BLOWER SHED FIELD INSTALLATION DETAIL AND BLOWER SHED CONSTRUCTION DETAIL



SITE LAYOUT

SCALE: 1" = 40'

Job No. 726876.20142				
Designed	MBP			
Drawn	MW			
Checked				
Reviewed				
Approved				
Reg No		A	1/09/98	RECORD DRAWING
Date		Rev	Date	Description

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AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)

EXTENDED BIOVENTING TREATABILITY TEST
IRP SITE 11 - AIRCRAFT GROUND EQUIPMENT MAINTENANCE AREA
BEALE AIR FORCE BASE

TITLE SHEET AND SITE LAYOUT

DRAWING NO: G-0.1 | REV: A

K:\AFCEE\726876\FIG\96DN1027, 11/18/96 at 2:18

ABBREVIATIONS

AIJ	AIR INJECTION
APPROX	APPROXIMATE
AST	ABOVEGROUND STORAGE TANK
ASTM	AMERICAN SOCIETY OF TESTING AND MATERIALS
&	AND
@	AT
CBM	CENTER BACK MOUNT
CLR	CLEAR
DIA	DIAMETER
EB	EXPLORATORY BORING
ECC	ECCENTRIC
EW	EACH WAY
FOT	FLAT ON TOP
FPT	FEMALE PIPE THREAD
FT	FOOT
GALV	GALVANIZED STEEL
ie	FOR EXAMPLE
LM	LOWER MOUNT
MAX	MAXIMUM
MIN	MINIMUM
MP	MONITORING POINT
MPT	MALE PIPE THREAD
NO, #	NUMBER
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
PVC	POLYVINYL CHLORIDE
PW	PROPOSED WELL
RED	REDUCER
REF	REFERENCE
SCH	SCHEDULE
S	SOCKET
SPVC	SLOTTED POLYVINYL CHLORIDE
THDD	THREADED
TYP	TYPICAL
UST	UNDERGROUND STORAGE TANK
VW	VENT WELL
W/	WITH
WN	WELD NECK
WWF	WELDED WIRE FABRIC

SYMBOLS

- VMP-1 ● — EXISTING BIOVENTING MONITORING POINT
- VW-1 ▲ — EXISTING VENT WELL
- EDGE OF ASPHALT
- PROPOSED HEADER PIPE TO VENT WELL
- CHAIN LINK FENCE
- UNLINED DRAINAGE CHANNEL AND DIRECTION OF FLOW

SECTION DESIGNATION (A / X) — SECTION NAME: **SECTION CUT** — SCALE: NTS — DRAWING OF ORIGIN — SCALE

DETAIL NO (1 / X) — DETAIL NAME: **DETAIL DESCRIPTION** — SCALE: NTS — DRAWING OF ORIGIN — SCALE

MATERIAL LEGEND

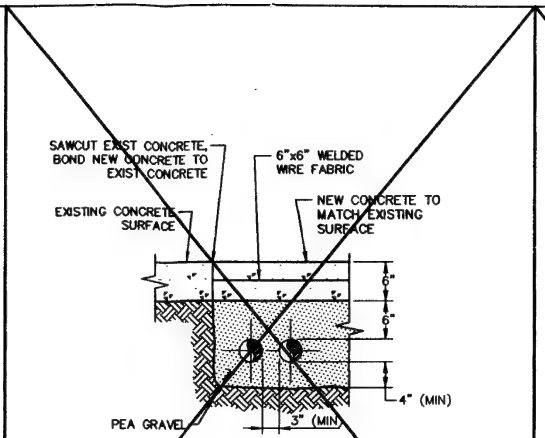
- ASPHALT
- BENTONITE
- BENTONITE/CEMENT GROUT
- BENTONITE PELLETS
- BUILDING (EXISTING)
- COMPACTED BACKFILL
- COMPACTED BASE STONE
- CONCRETE
- PEA GRAVEL
- SAND
- UNDISTURBED SOIL

PIPE MATERIAL

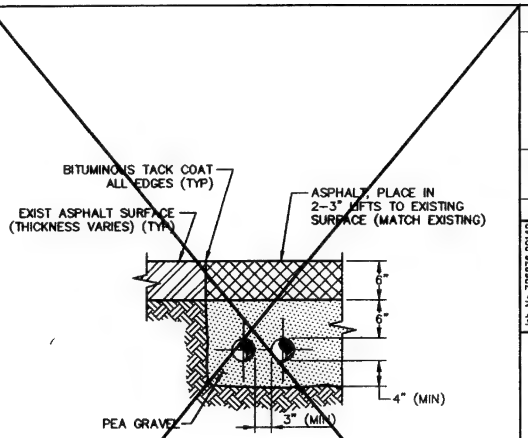
CS	CARBON STEEL
GALV	GALVANIZED STEEL
PVC	POLYVINYL CHLORIDE
SPVC	SCREENED POLYVINYL CHLORIDE

PIPE SERVICE

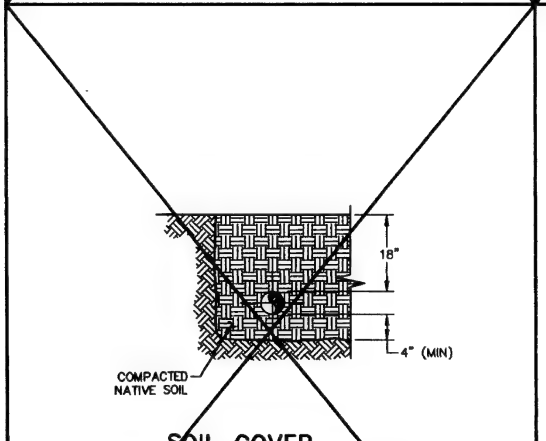
AIJ	AIR INJECTION
BIV	BIOVENTING
DR	DRAIN



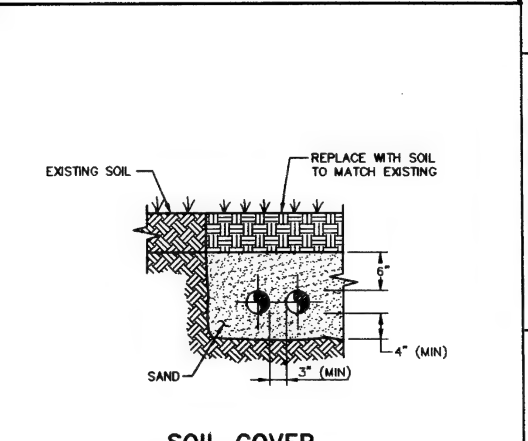
CONCRETE REPLACEMENT DETAIL (1 / –) — SCALE: NTS



ASPHALT REPLACEMENT DETAIL (2 / –) — SCALE: NTS



SOIL COVER REPLACEMENT DETAIL (3 / –) — SCALE: NTS



SOIL COVER REPLACEMENT DETAIL (4 / –) — SCALE: NTS

Job No. 726876.20.02
Designed MBP
Drawn MW
Checked
Reviewed
Approved
Req. No
Date

By	Description	Date	Rev
	RECORD DRAWING	1/06/96	A

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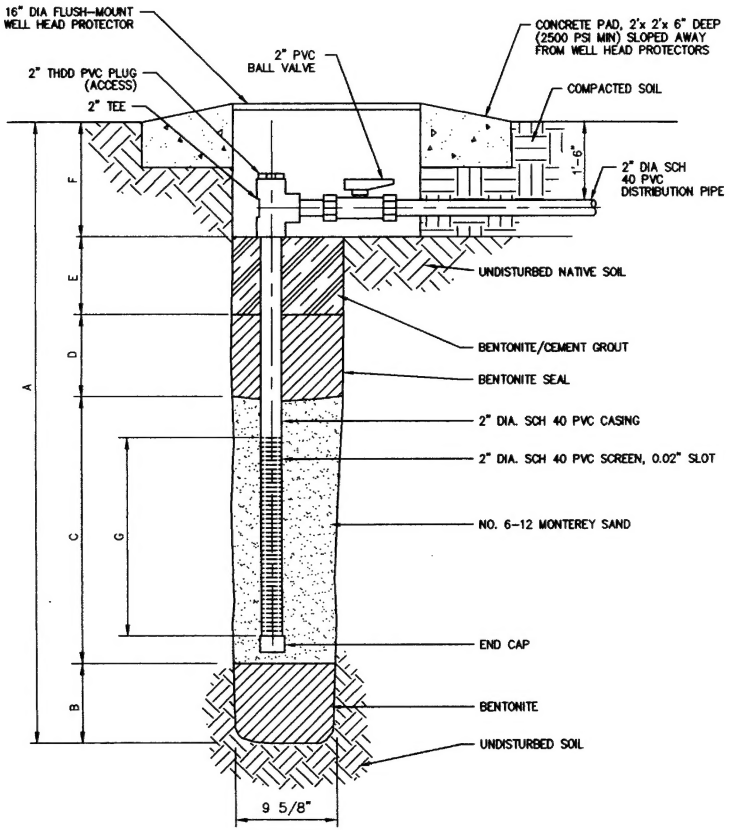
EXTENDED BIOVENTING TREATABILITY TEST
RP SITE 11 – AIRCRAFT GROUND EQUIPMENT MAINTENANCE AREA
BEALE AIR FORCE BASE

LEGEND AND STANDARD TRENCH DETAILS

DRAWING NO: G-0.2 — REV: A

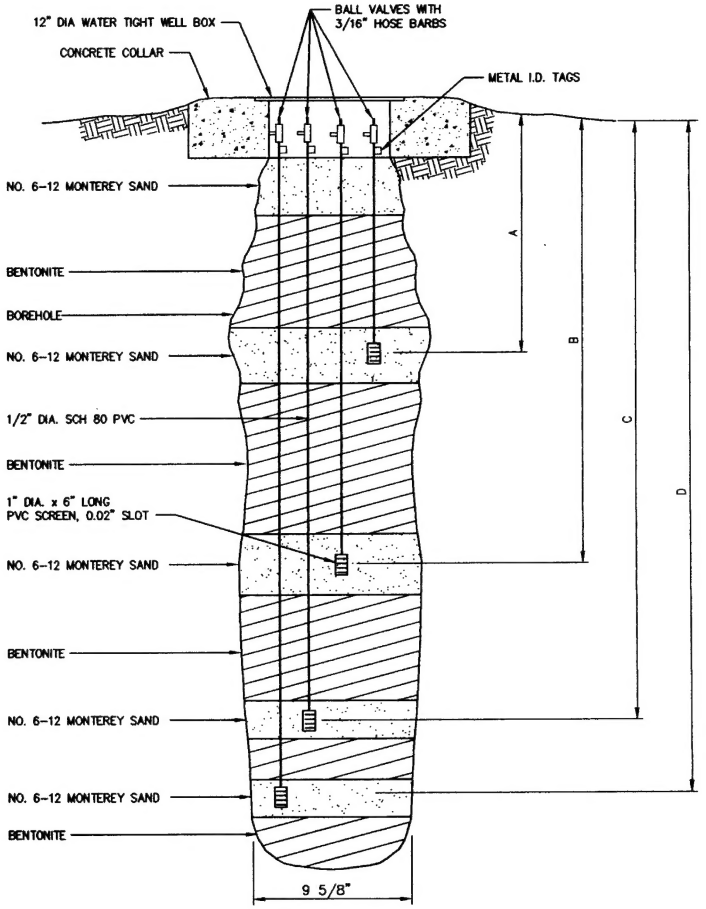
K:\AFCEE\726876\FIG\96DN1076, 11/04/96 at 10:32



WELL	WELL DIMENSIONS (FEET)						
	A	B	C	D	E	F	G
VW-2	50	8.5	33.5	4.5	2.5	1	30
VW-3	48	6	34	4	3	1	30

1 — VENT WELL (VW) DETAIL

SCALE: NTS



WELL	WELL DIMENSIONS (FEET)			
	A	B	C	D
VMP-4	10.5	24.3	30.4	40.5
VMP-5	10.0	23.9	30.2	39.6

2 — VAPOR MONITORING POINT (VMP) DETAIL

SCALE: NTS

By	Description	Rev	Date
		A	1/09/98

RECORD DRAWING

Job No. 726876.20142	
Designed	MBP
Drawn	MW
Checked	
Reviewed	
Approved	
Reg No	
Date	

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AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)

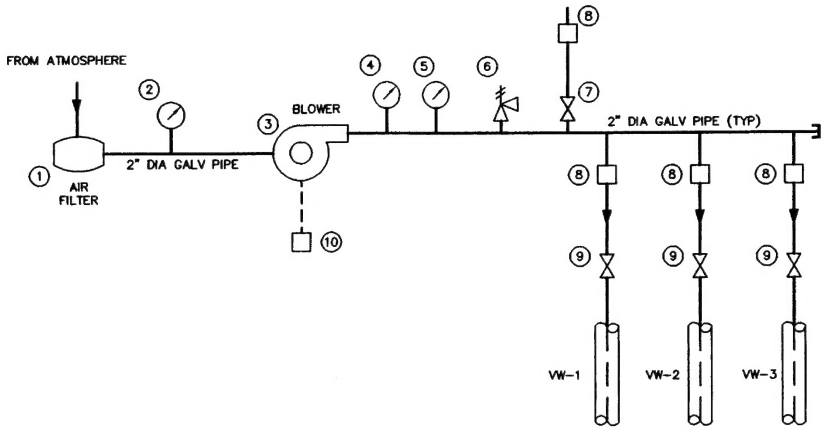
EXTENDED BIOVENTING TREATABILITY TEST
IRP SITE 11 - AIRCRAFT GROUND EQUIPMENT MAINTENANCE AREA
BEALE AIR FORCE BASE

VENT WELL AND MONITORING POINT STANDARD DETAILS

DRAWING NO: G-0.3

REV: A

K:\AFCEE\726876\FIG\96DN1028, 11/18/96 at 10:06



LEGEND

(1) INLET AIR FILTER – SOLBERG F-30P-200, REPLACEMENT ELEMENT 30P

(2) VACUUM GAUGE – GAST® 2 5/8" DIA., 0–60" H_2O, 1/4" NPT, LM (Part No. AJ497)

(3) BLOWER – GAST® 3.0HP R6130Q-50, 200 CFM AT 10" H_2O PRESSURE

(4) TEMPERATURE GAUGE – ASHCROFT, 0–250°F, 1/2" NPT, CBM (Part No. 2A606 FROM GRAINGER)

(5) PRESSURE GAUGE – WIKA 611.10, 2 1/2" DIA., 0–100" H_2O, 1/4" NPT, LM (Part No. 9851879)

(6) AUTOMATIC PRESSURE RELIEF VALVE – GAST AG258, SET TO RELEASE AT 50" H_2O PRESSURE

(7) MANUAL FLOW CONTROL (BLEED) VALVE – 2" GATE

(8) FLOW MEASURING PORT FITTED WITH PLUG (1/4"x 1/8" NPT BRASS REDUCING BUSHING, 1/8" NPT BRASS PLUG)

(9) FLOW CONTROL VALVE – 2" GATE

(10) STARTER

(1/–) BLOWER PIPING AND INSTRUMENTATION DIAGRAM

SCALE: NTS

Job No. 726876.20140					
Designed	MBP				
Drawn	MW				
Checked	RAF				
Reviewed					
Approved					
Reg No		A	1/08/96	RECORD DRAWING	
Date		Rev	Date	Description	By

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AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)

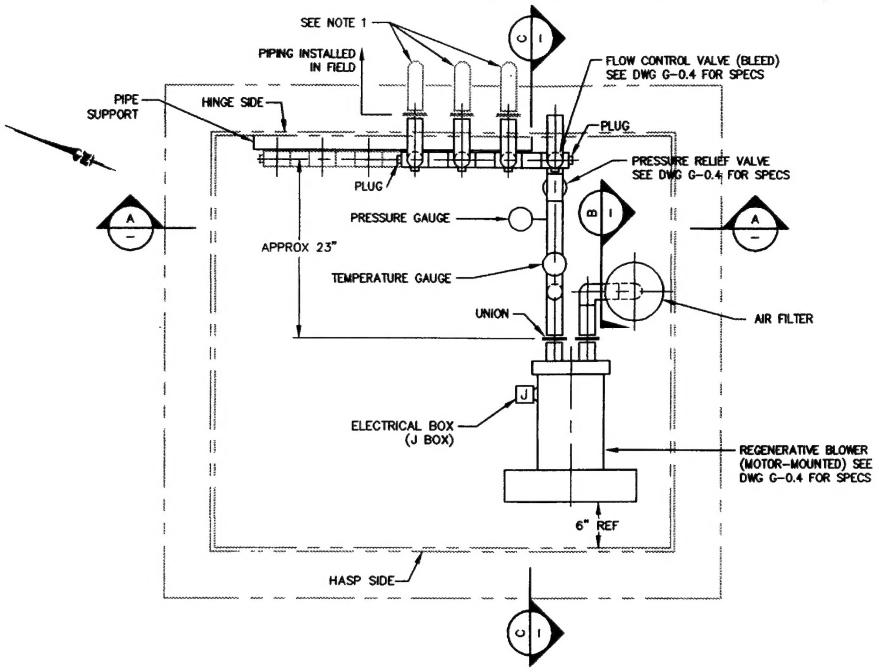
EXTENDED BIOVENTING TREATABILITY TEST
IRP SITE 11 – AIRCRAFT GROUND EQUIPMENT MAINTENANCE AREA
BEALE AIR FORCE BASE

BLOWER P & ID

DRAWING NO: G-0.4

REV: A

K:\AFCEE\726876\FIG\96DN1029, 11/05/96 at 08:49

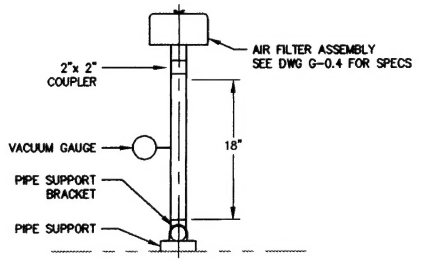


1 BLOWER PIPING LAYOUT PLAN DETAIL

3/4" = 1'-0"

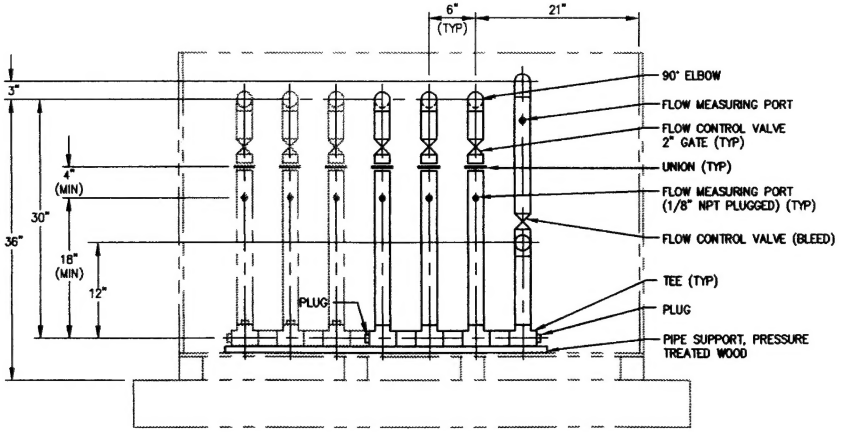
NOTES:

1. SHOP CORE HOLES TO PIPING DIMENSIONS
2. ALL PIPING 2" DIA. GALVANIZED STEEL, UNLESS OTHERWISE NOTED
3. SEE DRAWING G-0.6 FOR BLOWER BUILDING DETAILS



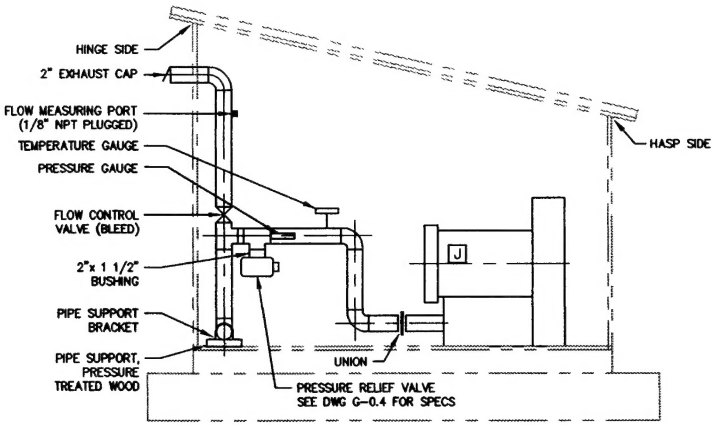
B BLOWER INLET PIPING SECTION

3/4" = 1'-0"



A MANIFOLD DETAIL SECTION

3/4" = 1'-0"



C BLOWER OUTLET PIPING SECTION

3/4" = 1'-0"

By	Description	Date	Rev
	RECORD DRAWING	1/08/96	A

Job No. 726876.20142
Designed MBP
Drawn MW
Checked RAF
Reviewed
Approved
Reg No
Date

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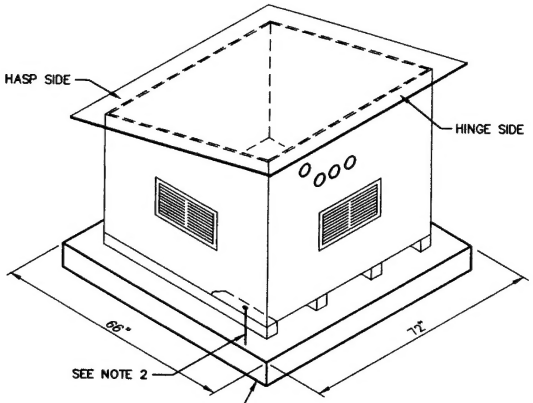
EXTENDED BIOVENTING TREATABILITY TEST
IRP SITE 11 - AIRCRAFT GROUND EQUIPMENT MAINTENANCE AREA
BEALE AIR FORCE BASE

BLOWER PIPING LAYOUT DETAIL

DRAWING NO G-0.5 | REV A

K:\AFCEE\726876\FIG\96DN1030, 11/05/96 at 08:47

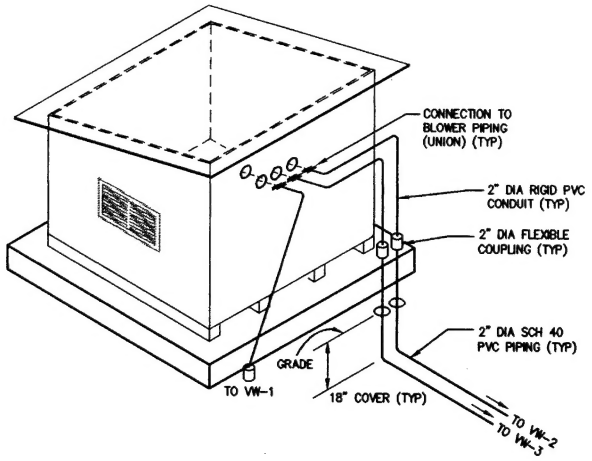


NOTES:

1. FIELD INSTALL BUILDING CENTRAL ON CONCRETE SLAB WITH ORIENTATION AS SHOWN
2. FIELD SECURE BLOWER SHED TO CONCRETE SLAB AT LOCATIONS BY THRU BOLTING. USE 3/8"x 6" LONG ST STL WEDGE ANCHOR BOLTS

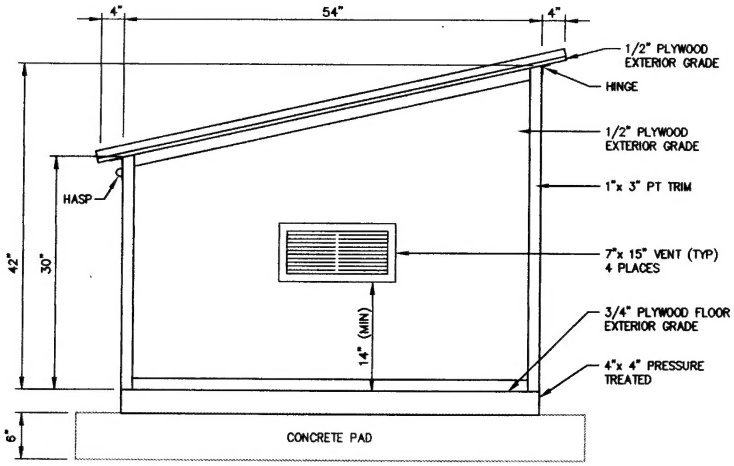
1 BLOWER SHED FIELD INSTALLATION DETAIL

NOT TO SCALE

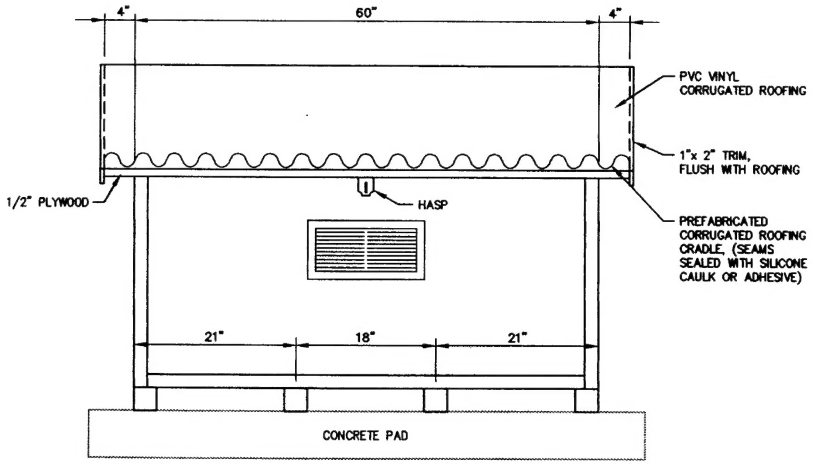


2 TYPICAL MANIFOLD DISCHARGE PIPING LAYOUT

NOT TO SCALE



SIDE ELEVATION



FRONT ELEVATION

NOTES:

1. 2"x 2" FRAME CONSTRUCTION
2. FLOOR CONSTRUCTED OF 3/4" EXTERIOR GRADE PLYWOOD
3. ROOF CONSTRUCTED OF 1/2" EXTERIOR GRADE PLYWOOD COVERED WITH PVC VINYL CORRUGATED ROOFING

3 BLOWER SHED CONSTRUCTION DETAIL

3/4" = 1'-0"

Job No. 726876.20142						
Designed	MBP					
Drawn	MW					
Checked						
Reviewed						
Approved						
Reg No						
Date						

Rev	Date	Description	By
A	1/08/96	RECORD DRAWING	

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AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)

EXTENDED BIOVENTING TREATABILITY TEST
RFP SITE 11 - AIRCRAFT GROUND
EQUIPMENT MAINTENANCE AREA
BEALE AIR FORCE BASE

BLOWER SHED FIELD INSTALLATION DETAIL AND BLOWER SHED CONSTRUCTION DETAILS

DRAWING NO: G-0.6
REV: A

K:\AFCEE\726876\FIG\96DN1031, 11/04/96 at 10:03